

**Space Control:
Is Army Investment Necessary?**

**A Monograph
by
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ABSTRACT

SPACE CONTROL: IS ARMY INVESTMENT NECESSARY? by MAJ George D. Wingfield, USA, 58 pages.

This monograph investigates Army involvement in space control capability development for the purpose of answering the question: Is Army investment necessary? The Army's future force is highly dependant on information superiority to maintain land warfare dominance while transforming to an expeditionary, jointly interdependent force. Space control provides the assurance of access to the space-based capabilities enabling information superiority and denying the same to an adversary. The importance of space control capabilities to the Army requires a capability development approach that meets Army near- and long-term needs, supports joint interdependence, and is fiscally feasible. The scope of this monograph is limited to an analysis of the available options to meet these requirements.

The three options for capability development explored are: 1) leverage the efforts of other Services, 2) focus on more conventional, terrestrial-based methods of space control against ground segments, and 3) develop and field capabilities within the Army. The analysis evaluates each option against the criteria of unity of effort, initial-entry force lethality and survivability, non-lethal capability and information superiority. The analysis is framed within the context of a developed scenario and Army space control needs during the early stages of conflict as an expeditionary force.

From this analysis, joint interdependence, in the near-term, does not allow for a completely passive approach by the Army. The importance of space control is accepted by all the Services however; service-unique requirements do not promote a common set of priorities in its attainment. Each option demonstrates different strengths and weaknesses against the criteria and the best solution is a melding of the three proposed courses of action. Successful harvesting of space control benefits by the Army is possible. Certain aspects of space control, especially in the areas of surveillance and prevention, are adequately addressed through the leverage approach. The ground approach provides a limited current capability in addressing protection and negation. Army capability development, however, is required in those areas, especially negation, where the Army's priorities are out of phase with the Air Force and Navy.

After evaluation of the Air Force's Strategic Master Plan and determination of any unacceptable space control capability timelines, shortfalls for the ground force become Army priorities. In particular, the Army should seek proponency for non-lethal, temporary negation from the ground to space and actively seek interservice and interagency partnerships to defray the fiscal burden of cradle-to-grave development. The Army is transforming to a joint, expeditionary force with the potential to create a more efficient military force through elimination of redundant capabilities. Until joint interdependence realization, however, the Army must pursue those capabilities that ensure its effectiveness as part of an evolving joint team.

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CHAPTER ONE

INTRODUCTION

“Despite official doctrine that calls for the integration of space and air capabilities, the Air Force does not treat the two equally.”

Report of the Commission to Assess United States National Security Space Management and Organization (Space Commission), 11 January 2001

This monograph assumes the reader’s acceptance of space’s importance to U.S. military operations in general and the U.S. Army in particular and focuses on the Army’s role in the space mission area of space control. The Army’s role in this mission area is not well defined or universally accepted. Of the four types of space control operations, this work focuses on protection and negation. These two areas address U.S. assured access and the denial of access to space by an adversary. Joint Publication (JP) 3-14, Joint Doctrine for Space Operations, defines the question of access as the providing or denial of freedom of action in space.¹ Is Army investment in space control necessary? This monograph intends to answer this question.

The necessary space control role for the Army is somewhat clouded by the Space Commission’s recommendation, and that recommendation’s subsequent implementation, that the Air Force assume the role of Executive Agent for Space within the Department of Defense (DoD).² This action is not a directive to abdicate responsibility for space operations to the Service owning Executive Agent authority. In fact, it has led to three primary schools of thought on the Army’s space control role: 1) leverage the efforts of other Services, 2) focus on more conventional, terrestrial-based methods of space control against ground segments, and 3) develop and field capabilities within the Army.

¹ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), IV-5.

² Commission to Assess United States National Security Space Management and Organization, *Report of the to Assess United States National Security Space Management and Organization* (Washington, D.C., 2001), Executive Summary, xxxiv.

Regardless of the form, space control is key to utilizing technology and realizing future force capabilities and as such, the Army must invest in this space mission area to ensure initial entry through post-conflict forces have access to space and can deny that access to an adversary. As the opening quote suggests, priority of effort is a question within the Service assigned as Executive Agent. After all, Air Force dominance in the air domain did not negate the need for and development of air defense capabilities by the other Services and, likewise, space control must be approached in a manner that addresses Service-unique or centric requirements. A definition of this mission area and its components enables a better understanding of space control requirements.

The space control mission area consists of four subset missions or operations: surveillance, protection, prevention, and negation. Surveillance is the surveillance of space to provide “continual awareness of orbiting objects, real-time search and targeting-quality information, and threat detection, identification, and location.”³ Protection includes active and passive measures that ensure “U.S. and friendly space systems perform as designed by overcoming an adversary’s attempts to negate friendly exploitation of space or minimize adverse effects if negation is attempted.”⁴ Prevention “precludes an adversary’s hostile use of U.S. or third-party space systems and services” through “military, diplomatic, political, and/or economic measures.”⁵ Negation is action taken to “deceive, disrupt, deny, degrade, or destroy an adversary’s space capabilities” and directed against “the ground, communication, or space segment of that system.”⁶ These abbreviated definitions are the framework for potential active Army involvement in space control in general and protection and negation in particular.

³ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), IV-6.

⁴ Ibid, IV-7.

⁵ Ibid.

⁶ Ibid.

Research and Methodology

Given the importance of space capabilities to Army operations and the threat to ground forces posed by an adversary's access to similar capabilities, Army involvement in the execution, maintenance, and attainment is required and necessary. The presented hypothesis is that within the three options presented in this monograph for space control involvement, there is an opportunity, based on the fundamental of unity of effort, the Army requirement for strategic responsiveness, and the Army core competency of sustained land dominance, for the Army to ensure its current and future effectiveness. This opportunity sets the conditions for a relevant contribution to joint warfighting capability by the Army. To prove this hypothesis, this monograph will compare and contrast the three involvement options in the context of the aforementioned criteria, doctrinal Service roles and responsibilities, and the current and future operational environments.

First, the recommended course of action must adhere to the fundamental of unity of effort. JP 1-0, Joint Warfare of the Armed Forces of the United States, states "unity of effort demands that all undertakings be directed toward achievement of common aims."⁷ The three presented options are evaluated as to which is the most efficient (smallest duplication of effort and chance for incompatible inter-Service systems) and which best promotes inter-Service cooperation.

For the second criterion, the Army defines strategic responsiveness as "Army forces trained, organized, and equipped for global operations."⁸ The two attributes of strategic responsiveness used as evaluation criteria in this monograph are lethality and survivability. Under lethality, Army forces combine the elements of combat power: maneuver, firepower, leadership, protection, and information to defeat the enemy and, strategically, balance the ability

⁷ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 1-0: Joint Warfare of the Armed Force of the United States (November 2000), III-9.

to mass against the requirement to deploy.⁹ Additionally, Field Manual (FM) 3-0, Operations, lists the lethality of the deploying force as a consideration of strategic responsiveness.¹⁰ Army doctrine requires initial entry forces to have sufficient combat power to begin shaping operations immediately upon arrival.¹¹ Access to and control of space are critical to this capability. FM 3-0 defines survivable as the combination of “technology and methods that afford the maximum protection to Army forces.”¹² The FM links lethality and survivability with its statement that “lethal forces destroy enemies before they strike.”¹³ Access to Intelligence, Surveillance, and Reconnaissance (ISR) capability from space is essential in meeting this requirement. The three presented options are evaluated as to which best enhances the Army initial-entry force’s lethality and survivability.

Finally, according to FM 1-0, The Army, “the Army Core Competencies are the essential and enduring capabilities of the Army.”¹⁴ Of these competencies, this monograph uses the competency of sustained land dominance as a criterion basis. As part of sustained land dominance, precision fire and maneuver is the capability to attack “an enemy directly or indirectly, with lethal and non-lethal means.”¹⁵ Information superiority is essential to decisive Army operations and required to enhance the common operating picture, situational understanding, and the ability to affect an adversary’s will to resist.¹⁶ The three presented options

⁸ Department of the Army, Field Manual 3-0: Operations (June 2001), 3-0.

⁹ Ibid., 3-4.

¹⁰ Ibid., 3-6.

¹¹ Ibid.

¹² Ibid., 3-4.

¹³ Ibid.

¹⁴ Department of the Army, Field Manual 1-0: The Army (June 2001), 22.

¹⁵ Ibid., 23.

¹⁶ Ibid., 23-24.

are evaluated as to which best supports the use of non-lethal means to attack the enemy directly or indirectly and which best support the early achievement of information superiority.

Chapters 2 and 3 establish the space control operational environment and the involvement options under consideration for use in that environment. To establish the proper context for evaluation, Chapter 2 describes the current doctrinal Service roles and responsibilities. This chapter also explains the current and future threat, need, legal considerations, and joint environment concerning space control. Presentation of the three involvement options is within the context of this overall space control environment. Chapter 3 defines in detail the three involvement options. It details the pros and cons of each option given the environment presented in Chapter 2. This chapter demonstrates the viability of these options by describing the feasibility, acceptability, and suitability of each.

Chapters 4 and 5 detail the evaluation criteria, compare the options presented, and provide the derived conclusions and recommendations concerning Army space control. Chapter 4 compares and contrasts each option as evaluated against the established criteria. The focus of the evaluation is the Army's ability to gain and maintain initial-entry force survivability and information superiority in the Joint Operational Area. Chapter 5 summarizes the result of the research presented throughout the monograph and offers a cohesive answer to the research question. This chapter provides recommendations on Army space control methodology and resource focus.

The scope of this monograph is limited to the exploration of Army roles and functions within the space control mission area that enable continued exploitation of space assets by Army forces to prosecute the nation's wars and maintain sustained land dominance. The anticipated ancillary benefit of this work is increased awareness of space operations and understanding of space's importance to the success of all joint operations.

CHAPTER 2

SPACE CONTROL ENVIRONMENT

Since the implementation of numerous recommendations by the Space Commission, the structures for command and control (C2) of space forces and Service roles and responsibilities have evolved within the framework of those recommendations. This chapter uses several Department of Defense (DoD), Joint, and Service references to outline the space control responsibilities of each Service in order to establish a foundation for evaluation of Army options for involvement in the space control mission area. It also refines the current and future space control environment by describing the threat to U.S. space superiority, the Army's need for space control, the legal issues surrounding space control operations, and the Joint environment in which space control capabilities are introduced. Describing these areas establishes the proper context within which to evaluate the Army's involvement options.

Service Roles and Responsibilities

The first step to establish the space control environment is to state the Service roles and responsibilities assigned in this mission area by doctrine and DoD directive. The base, cabinet-level document concerning U.S. space policy is DoD Directive (DoDD) 3100.10 (9 July 1999) and predates the Space Commission's report. The directives provided by this document for implementing space policy are, however, still valid. The Chairman of the Joint Chiefs of Staff (CJSC) is directed to "establish a uniform system for evaluating the readiness" of units to employ space forces, "develop joint doctrine for the operation and employment of space systems", and "provide guidance to Combatant Commanders for planning and employment of space capabilities."¹⁷ The directive's guidance to Combatant Commanders requires coordination with

¹⁷ Department of Defense, Department of Defense Directive 3100.10: Space Policy (July 1999), 18-19.

U.S. Space Command.¹⁸ This command merged with U.S. Strategic Command in 2002 and now has most of the responsibilities previously assigned to U.S. Space Command.¹⁹ U.S. Space Command was designated “to serve as the single point of contact for military space operational matters”, to “conduct space operations, including strategic ballistic missile defense”, and “to advocate space (including...space control...) and missile warning requirements of other Combatant Commanders.”²⁰ This Department-level directive demonstrates space control is an integral part of joint warfighting.

JP 3-14, published in response to DoDD 3100.10 requirements for the CJSC, post-dates the Space Commission but pre-dates the merger of U.S. Space Command and U.S. Strategic Command. It directs that the Services “integrate space capabilities into all facets” of their activities, U.S. Space Command ensures “the most effective use” of space assets, and joint space support teams assist combatant commands in integrating space capabilities.²¹ Additionally, this publication defines the Service components’ space missions.

Army Space Control Responsibilities

The Army “includes land combat and service forces and any organic aviation, space forces, and water transport assigned.”²² The Department of Defense has directed the Army “to organize, train, equip, and provide forces for appropriate air and missile defense and space operations unique to the Army” and to develop “doctrines, procedures, and equipment employed

¹⁸ Ibid., 19.

¹⁹ Sonja Chambers, Petty Officer 1st Class, Special to the American Forces Press Service, “Strategic, Space Commands Merge,” American Forces Information Service News Articles (01 October 2002): 1, GEN Myers quote, available from http://www.defenselink.mil/news/Oct2002/n10022002_200210021.html; Internet; accessed 03 March 2004.

²⁰ Department of Defense, Department of Defense Directive 3100.10: Space Policy (July 1999), 19-20.

²¹ Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Publication 3-14: Joint Doctrine for Space Operations* (August 2002), Executive Summary, viii.

²² Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 16.

by Army forces in the conduct of space operations.”²³ DoDD 5100.1 does not define the term “space operations unique to the Army.” JP 3-14 designates specific space-related missions to the Army Service Component Command for its space forces. However, this is a narrow and incorrect definition of unique Army space operations. Chapter 4 presents possible Army-unique space control requirements that create the potential for additional, unique, Army space operations. The Army, as a collateral function, must “train forces to interdict enemy sea, space and air power, and communications through operations on or from land.”²⁴ To accomplish these tasks the Army utilized the Army Space Command (ARSPACE) and the Space and Missile Defense Command (SMDC).

ARSPACE and SMDC reorganized after publication of JP 3-14. ARSPACE primarily exists now as the Army Space Forces (1st Space Brigade (Provisional) and Ground Missile Defense Brigade) and is directly subordinate to SMDC. SMDC is the Army Service Component Command for U.S. Strategic Command.²⁵ Those responsibilities previously assigned to ARSPACE are still valid and fall under the overall purview of SMDC.²⁶ SMDC, as the Army Service Component to U.S. Strategic Command, provides “space control operations...to the joint force and Army component”, provides “theater missile warning”, and “functions as the SATCOM system expert for...super-high frequency satellite communications.”²⁷ SMDC is designated as the major command responsible to organize, train, equip, and provide forces and plan for national

²³ Ibid., 17.

²⁴ Ibid., 18.

²⁵ Space and Missile Defense Command, Organization and Contacts: Organization Elements; available from http://www.smdc.army.mil/SMDC2004/org_poc.html; accessed 09 January 2004.

²⁶ References cited in this work and published before SMDC reorganization refer to Army Space Command instead of SMDC. To avoid confusion, “SMDC” is the term used in place of “ARSPACE” for the remainder of this monograph. This author believes this substitution to be valid, as SMDC has assumed ARSPACE responsibilities as the Army component to U.S. Strategic Command and was the ARSPACE MACOM before reorganization.

²⁷ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), II-3.

missile defense and space operations.²⁸ As part of the realignment to U.S. Strategic Command, SMDC assumed, in addition to space operations, four other mission areas: information operations, missile defense, strike, and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR).²⁹ SMDC adopted these mission area titles to align with the U.S. Strategic Command (STRATCOM) missions of Global Missile Defense, Information Operations, Global Strike, and C4ISR.³⁰ The fifth STRATCOM mission, Space Operations, was already resident in SMDC.

In concert with organizational changes, the Army republished its space policy in April 2003. This document reinforces the role of space dominance and full exploitation of space-based systems in achieving future force capabilities.³¹ Three of the five essential tasks recognized by this document directly relate to space control: support precision maneuver, fires, and sustainment, contribute to continuous information and decision superiority, and protection of the force during all phases of the operation.³² Based on these tasks the Army states it will pursue and advocate six space capabilities. These capabilities are responsive space-based ISR sensors integrated with other battlespace sensors, integrated and mobile satellite communications, responsive and tactically relevant space control capabilities, missile warning and tracking information directed to forces and battle command systems, jam-resistant Global Positioning System capability, and advanced environmental monitoring capability.³³ All six depend on the ability to execute the

²⁸ Ibid.

²⁹ Rich Tuttle, "SMDC On Track For Wider Role With Strategic Command, Cosumano Says," *Aerospace Daily* (11 August 2003), reprinted in *Space News* (12 August 2003), U.S. Army Command and General Staff College, 2.

³⁰ Debra Valine and Becky Proaps, eds., "Exercise first in a series to test SMDC's new role as Army Service Component to U.S. STRATCOM," *The Eagle* 10, no. 8 (August 2003): 4.

³¹ Space and Missile Defense Command, About SMDC: Army Space Policy 2003; available from <http://www.smdc.army.mil/PubAff/2003ArmySpacePolicyApr03.pdf>, accessed on 09 January 2004, 1.

³² Ibid.

³³ Ibid., 1-2.

space control mission area and one or more of its operations. Space control is specifically mentioned in only one of these capabilities and that is the capability for “responsive, tactically relevant space control capabilities synchronized and integrated with land, sea, air, and information operations to...rapidly assess space impacts to operations, protect land force interfaces to space systems, and, if necessary, negate enemy use of space systems capabilities.”³⁴ It is clear from a doctrinal perspective that the Army received and accepted a stake in the space control mission area, and this area has continued to be a priority through numerous reorganizations. Space control is a joint concern and the other Services have a stake.

Air Force Space Control Responsibilities

DoDD 5100.1 states, “The Air Force...includes aviation and space forces, both combat and service, not otherwise assigned.”³⁵ DoDD 5100.1 assigns similar organize, train, equip, and provide direction as that assigned to the Army. The major difference is that, while the Army performs these functions for space operations unique to the Army, the Air Force does not have this Service-specific directive. This implies the Air Force has an overall responsibility for space control organizing, training, equipping, and force providing. This directive tasks the Air Force “to develop, in coordination with other Services, doctrines, procedures, and equipment for air and space defense from land areas, including the United States.”³⁶ Inter-Service or joint coordination on the development of doctrine and capabilities is thematic throughout DoDD 5100.1 concerning space functions.

JP 3-14 designates Space Air Forces as the component to the former U.S. SPACECOM with the mission of operating “space forces for ballistic missile warning, navigation,

³⁴ Ibid., 2.

³⁵ Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 24.

³⁶ Ibid.

communications, spacelift and space control, and to provide satellite operation capabilities.”³⁷

This section of JP 3-14 is comparatively sparse. The Air Force became DoD’s Executive Agent for Space in 2001.³⁸ DoD defined this position’s responsibilities in June of 2003.³⁹

Undersecretary of the Air Force Peter B. Teets, also the Director of the National Reconnaissance

Office, performs the duties of DoD’s Executive Agent for Space.⁴⁰ An Executive Agent within

the DoD is “assigned specific responsibilities, functions, and authorities...prescribed at the time of assignment” until revoked by the Secretary of Defense or the Deputy Secretary of Defense.⁴¹

The Executive Agent for Space must “develop, coordinate, and integrate plans and programs”, to include acquisition, for space systems.⁴² All Services must coordinate their planning,

programming, and acquisition activities with the Executive Agent.⁴³ This coordination

requirement, however, does not preclude component authorities “prescribed by law, Executive

Order, or DoD guidance.”⁴⁴ The Executive Agent is the steward of DoD’s space program and

carries the responsibility of efficiently meeting the Services’ space needs.

³⁷ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), II-4.

³⁸ Department of Defense, Secretary of Defense, “News Release No. 201-01: Secretary Rumsfeld Announces Major National Security Space Management and Organizational Initiative,” 08 May 2001, 2, available from http://www.defenselink.mil/news/May2001/b05082001_bt201-01.html; Internet; accessed 08 January 2004.

³⁹ Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 1.

⁴⁰ Glenn W. Goodman, Jr., “Assured Access To Space,” *Armed Forces Journal International* (July 2002): 1.

⁴¹ Department of Defense, Department of Defense Directive 5101.1: DoD Executive Agent (September 2002), Certified Current as of November 2003), 2.

⁴² Department of Defense, Department of Defense Directive 5101.2: DoD Executive Agent for Space (June 2003), Certified Current as of November 2003), 2.

⁴³ *Ibid.*, 3, 6-7.

⁴⁴ *Ibid.*, 8.

Naval Space Control Responsibilities

The Navy has authority “to conduct such land, air, and space operation as may be essential to the prosecution of a naval campaign.”⁴⁵ Like the Army and Air Force, it has authority “to organize, train, equip, and provide forces for...space operations.”⁴⁶ The interdiction of “...enemy land, air, and space power and communication through operations at sea” is a collateral function of the Navy and Marine Corps.⁴⁷ The Navy accomplishes these tasks through the Naval Network Warfare Command and the Naval Network and Space Operations Command (NNSOC).⁴⁸

JP 3-14 assigns NNSOC the mission of ensuring “space-based support to naval warfighters.”⁴⁹ NNSOC supports the surveillance operation of the space control mission area through operation of the Naval Space Surveillance System and maintains the Alternate Space Control Center (ASCC).⁵⁰ The ASCC provides alternate command and control of the space surveillance network.⁵¹

As the previous sections demonstrate, each service has a stake in space control and can make a case for Service-unique requirements. The Executive Agent vets these requirements as they compete for DoD dollars to ensure meeting the best interests of the DoD and national security. It is important to distill from these doctrinal guidelines that there is a single point of

⁴⁵ Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 20.

⁴⁶ Ibid., 21.

⁴⁷ Ibid., 22.

⁴⁸ Like the Army, the Navy has recently reorganized its space forces. Some references used in this document refer to Naval Space Command. To avoid confusion, the terms NAVSPACECOM is not used and is replaced by either NETWARCOM or NNSOC.

⁴⁹ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), II-3.

⁵⁰ Ibid.

⁵¹ Ibid.

contact, the Executive Agent, for channeling Service space requirements and the only limitation on a Service's effort to pursue its own systems is its own spending limitations. To compete for joint funding, the Service must demonstrate joint applicability. The next step in defining the context of the space control environment is to move from the doctrinal environment to the physical environment.

The Physical Space Control Environment

The Threat

The threat to U.S. space superiority is real and endangered by entities without their own spacefaring capability. In August of 2003, Cuba informed the United States that an Iranian diplomatic facility in Cuba was the source of the jamming of U.S. Farsi-language broadcasts to Iran the previous month.⁵² An article in *Jane's Weekly* makes reference to Iraqi attempts to jam Global Positioning System signals and suggests the inadequacy of kinetic means to respond to these types of efforts by future adversaries.⁵³ These incidents highlight the ability to disrupt U.S. space-based capabilities from a terrestrial-based platform. In addition to electronic warfare, numerous nations and corporations sell increasingly higher resolution electro-optical imagery⁵⁴ to anyone willing to pay the cost.⁵⁵ In addition to increasing numbers of nations pursuing a space

⁵² Agence France-Presse, 'Havana Says Iran Jammed Satellite,' *Washington Times* (26 August 2003): 9, available from <http://ebird.dtic.mil/Aug2003/s20030826211536.html>, accessed on 26 August 2003.

⁵³ Andrew Koch, 'US Seeks Solution to Space Threats,' *Jane's Defence Weekly* (13 August 2003), available from <http://ebird.dtic.mil/Aug2003/s20030811207468.html>, accessed on 11 August 2003.

⁵⁴ As an example, IKONOS® is an imaging platform launched by Space Imaging® that sells this imaging over the Internet at <http://www.spaceimaging.com>. The resolution is as good as 0.82 meters with revisits as frequent as 3 days. This data is from the IKONOS Product Guide, ©2003 Space Imaging, LLC; available from http://www.spaceimaging.com/whitepapers_pdfs/IKONOS_Product_Guide.pdf; Internet; accessed 29 February 2003.

⁵⁵ Ann Roosevelt, "Space Control Vital for Future Operations, General Says," *Defense Daily*, 03 November 2003; available from <http://ebird.afis.osd.mil/ebfiles/s20031103229632.html>; Internet; accessed 03 November 2003, LTG Cosumano quote.

program, non-spacefaring entities can buy imagery⁵⁶, rent transponders on communication satellites, and purchase or develop jamming capabilities.⁵⁷

While these threats are significant, they are not all inclusive. A space system is composed of three segments: the platform in space, the ground segment consisting of command and control means and the terminal end item/user, and the communications that link the platform with the ground segment. Attack of any of these segments denies or degrades U.S. space capabilities. The space control mission area protects our systems, prevents their use by an adversary, or negates an adversary's ability to utilize space-based capabilities.

The Need for Space Control

There are two aspects to the need for space control. The first is the ability to retain use of our space-based assets. The second is to prevent an adversary from using space-based assets against us. Robert Dickman, deputy for military space in the Office of the Undersecretary of the Air Force, stated in Jane's Defence Weekly "The U.S. is "beyond the point where we can successfully prosecute a war without space systems."⁵⁸ The loss of space capability means the loss of precision munitions guidance, the loss of early warning to a ballistic missile attack, the loss of surveillance in denied access regions, the loss of responsive, over-the-horizon communications, and the loss of accurate weather predictions. This demonstrates that many of the capabilities required by combat forces are space-derived.

⁵⁶ Ibid.

⁵⁷ Kerry Gildea, "DIA Chief Reports Enemies Have Ability To Attack Space Assets," *Defense Daily*, 12 February 2003; available from <https://www.armyspace.army.mil/news/newsdetail.asp?HL=2&NID=857&dc=6&>; Internet; accessed 07 August 2003; VADM Jacoby interview.

⁵⁸ Ibid.

Prevention of an adversary's use of space is also important. One-meter resolution imagery is readily available on the international market through the Internet.⁵⁹ While this imagery may not be useful for near-real time intelligence or time-sensitive targeting, it is adequate for detailed attack planning and determination of indicators to U.S. intentions. Similarly, satellite communication capability is for sale or rent to assist in an adversary's command and control for the relatively small amount of under \$100,000 per month.⁶⁰ For those nations with an organic space capability, their systems may be a generation or two behind the U.S. but the proliferation of technology can quickly close that gap. Even with a capability less advanced than ours, an enemy with surveillance and communication capability could threaten U.S. forces more effectively than one with no space-based capability. Globalization and technology proliferation and transfer create an environment where the threat to U.S. forces and U.S. space superiority from space-based capabilities emanates from both space and non-spacefaring entities alike. Some of the difficulty in utilizing space control to address these potential threats lies more in the legal arena than the technological.

Legal Issues

There are numerous laws and treaties governing space activities and its role in the use of force. While limitations imposed by domestic law are within the purview of the U.S. government to change, international prohibitions are much more difficult to change, circumvent, or to abrogate.⁶¹ The conduct of space control operations requires the consideration of international

⁵⁹ See footnotes 54 and 55.

⁶⁰ Intelsat USA License Corp., Vice President, Contracts, *Publication 1: Rates, Terms, and Conditions for Service* (Washington, D.C.: Intelsat®, 2004), 24; available from <http://www.intelsat.com/pdf/en/telecomisp/rtc.pdf>; Internet; access 06 March 2004.

⁶¹ Amy Butler, 'Rice Wants President to Initiate Sweeping Space Policy Review,' *InsideDefense.com* (14 May 2002), accessed from <http://www.californiaspaceauthority.org/pr020517.html>, accessed on 26 August 2003.

law.⁶² This consideration is valid when considering non-combatants and second- and third-order effects. For example, removing an adversary's ability to use satellite communications could have a detrimental effect on civilian emergency response operations. Likewise, removing accurate GPS signals could adversely affect civilian transportation systems, such as air and sea, which in turn affects passengers and the delivery of essential goods and services.

Two areas of international agreements that could pose restraints on the conduct of space control negotiation operations are arms control treaties and frequency spectrum management. Several arms control treaties prohibit interference with treaty compliance verification methods to include reconnaissance satellites.⁶³ The International Telecommunications Union governs the radio frequency spectrum and nations have sovereignty over frequency usage within their borders.⁶⁴ This environment could make it politically difficult to negate space-based capabilities provided by third parties to adversaries.

The Joint Environment

The final factor defining the space control environment is the joint environment. Fiscal concerns and perceived ownership play a role in integrating mission needs. Army persistence and ability to articulate space capability needs is essential in ensuring the required joint capability creation. The Executive Agent has overall DoD responsibility to ensure meeting DoD's space needs; however, there are finite resources available. The Executive Agent makes decisions on those capabilities that are most cost effective and have the greatest potential for joint applicability. If joint priorities subsume Service needs, nothing prevents unilateral development

⁶² Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 3-14: Joint Doctrine for Space Operations (August 2002), I-4.

⁶³ Ibid.

⁶⁴ Ibid.

of a capability or the system required to exploit an existing capability. This approach, however, is costly as shown by the GPS costs borne by the Air Force.⁶⁵

In this defined space control environment, each Service has the ability and responsibility to identify its own needs in this mission area. However, space systems and capabilities are extremely cost prohibitive. The designation of an Executive Agent for Space with the authority to determine those capabilities pursued with joint funds assists in the sound stewardship of DoD dollars. Adversaries will gain increasing access to space through commercial venues, agreements with spacefaring entities, or the development of organic space capabilities. Additionally, the proliferation of technology will increase the availability of systems or methods to disrupt U.S. use of space. The need for space control is undeniable; as the loss of access to space would deny the C4ISR capabilities, the U.S. depends upon to prosecute war. Additionally, adversarial use of space severely threatens U.S. forces in theater and national security. Legal restrictions or constraints exist but they do not preclude the right of self-defense. The exploration of existing domestic and international laws and treaties is required to determine their continued relevance or acceptability. The environment defined in this chapter requires the Army to persistently advocate its space control needs and, when necessary, make difficult funding decisions if unilateral development and fielding in necessary.

⁶⁵ An incomplete but substantial cost is developed and provided in Chapter 3 under “Option 1: Leverage.”

SPACE CONTROL OPTIONS FOR THE ARMY AND CRITERION DEVELOPMENT

This study evaluates three options for the Army's space control efforts: 1) leverage the efforts of other services, 2) focus on more conventional, terrestrial-based methods of control against ground nodes, and 3) develop and field capabilities within the Army. These options are derived primarily from a series of articles found in *The Army Space Journal*'s Summer 2003 edition entitled, "The Army's Future in Space: What the Army Can Do for Space."

John Marrs' article "Is It Enough?: Army Innovation in Its Use of Space" provides the basis for the first option. This article discusses Army innovation concerning space and concludes that the Army has made the fiscally prudent choice to leverage capabilities in lieu of pursuing a cradle-to-grave methodology.⁶⁶ The second option arises from LTC Dean Taylor's and CW4 Daniel Rupp's article "Start Line: Targeting and Adversary's Space Capabilities Begins with the Terrestrial Segment." This article argues that, because the ground segment, consisting of fixed and mobile nodes, is the most vulnerable part of a space system, it should receive the priority of effort in the Intelligence Preparation of the Battlespace (IPB), and that the Army should take the lead in developing the capabilities to attack this segment.⁶⁷ Articles in *The Army Space Journal* and the Association of the United States Army's (AUSA) Space and Missile Defense Issue of *Army Magazine* form the third option. In the December 2003 issue of *Army Magazine*, BG John M. Urias recommends the Army define space requirements and presents these needs in joint processes or the Army "will continue to depend on space-based assets primarily designed and

⁶⁶ John Marrs, "Is It Enough?: Army Innovation in Its Use of Space," *The Army Space Journal* 2, no. 2 (summer 2003): 51.

⁶⁷ Dean Taylor, LTC and Daniel Rupp, CW4, "Start Line: Targeting an Adversary's Space Capabilities Begins with the Terrestrial Segment," *The Army Space Journal* 2, no. 2 (summer 2003): 46.

engineered to meet other services' requirements."⁶⁸ BG Urias also proposes that if Army needs are not met by the proponents for space-based systems because of fiscal constraints, considerations must be made toward alternative funding or to accept "degradation in future force capability."⁶⁹ Tomás A. Pagán's article "The High Ground: We Have It! We Like It! Can We Keep It?" in the Summer 2003 *Army Space Journal* discusses three possibilities for the future U.S. ability to maintain space superiority.⁷⁰ In his discussion of the first possibility, luck, he recognizes the Army's success in exploiting capabilities developed by other Services, but makes the point that continued success in this vein is gambling that the developers will create space systems applicable to land warfare's next challenge in the contemporary operating environment.⁷¹ The following paragraphs provide a detailed description of each option and their ability to meet feasibility, acceptability, and suitability (FAS) requirements. A course of action is feasible, acceptable, and suitable if it "fits within available resources," is "worth the cost or risk," and "solves the problem or accomplishes the mission," respectively.⁷² In addition, they provide the major advantages and disadvantages for each option within the space control operating environment.

Option 1: Leverage

Leveraging or exploiting existing and planned space-based capabilities is a method to limit exposure to the research and development (R&D), launch, and on-orbit maintenance costs

⁶⁸ John M. Urias, BG, "Space Technology and Concept Development for the Army's Future Force," *Army Magazine* (December 2003): 36.

⁶⁹ Ibid.

⁷⁰ Tomás A. Pagán, "The High Ground: We Have It! We Like It! Can We Keep It?," *The Army Space Journal* 2, no. 2 (summer 2003):22.

⁷¹ Ibid.

⁷² Department of the Army, "Field Manual 5-0: Army Planning and Orders Production (Final Draft) (July 2002), Chapter 2, pg. 7.

associated with a cradle-to-grave approach to a space-based capability. The premise is simple; evaluate existing or developmental capabilities, determine the applicability to ground force requirements, and develop the ground segment to exploit the capability. This method in isolation, however, is more reactive than proactive. Under this option, the Army waits to determine if a capability is developed that is exploitable. By contrast, the proactive approach determines which shortfalls exist and designs a capability to mitigate or remove that shortfall. Furthermore, its success depends on the fortuitous development of a capability by an entity outside the Army needs-development process. Stellar examples of success, such as the Global Positioning System (GPS), Blue Force Tracking (BFT), and the Joint Tactical Ground Station (JTACS), support the leverage option. BFT and JTACS programs respectively provide the Army with enhanced Identification Friend or Foe (IFF) and theater ballistic missile early warning, respectively, and leverage capabilities not designed for those specific purposes. The GPS example suffices to demonstrate the FAS-test for this option and highlight the option's major positive and negative aspects.

The Navy TRANSIT system, developed to enable accurate locations for Navy ballistic missile submarines, was the origin of today's GPS.⁷³ This technology evolved into the current GPS constellation of twenty-nine operational satellites (including spares) enabling accurate location by U.S. ground forces using an estimated 100,000 portable and vehicular receivers.⁷⁴ However, GPS did not come into existence specifically for Army use. The Air Force developed GPS for missile and aircraft guidance and location. The Army's cost for this capability was limited to the R&D and fielding costs associated only with the ground receivers. While exact costs for the R&D, launch, and on-orbit maintenance borne by Air Force in creating and

⁷³ Aaron Reneger, "Global Positions System celebrates 20 years of service," AFMC News Service #98-3-20, available from <http://www.fas.org/spp/military/program/nav/03-23-98.htm>; Internet; accessed 26 January 2004.

⁷⁴ Ibid.

maintaining the GPS space system are unavailable, deduced costs are possible using published launch cost estimates and reported Iridium® SATCOM on-orbit maintenance costs. The following modified cost-benefit analysis demonstrates the major advantage to the leverage approach for the Army.

Iridium was a commercial venture designed to provide the first truly global, on-demand, mobile communications capability to its subscribers. The two systems, Iridium and GPS, provide disparate capability (communications vice positioning) but offer sufficient commonalities in constellation size and maintenance to enable an extrapolation of on-orbit costs from the Iridium system to GPS. The use of Iridium data for estimation of on-orbit costs is acceptable because of its similarity to GPS; it provides global coverage of its capability and occupies an area of space of roughly similar distance from the Earth's surface. Launch cost data is derived from the current launch vehicle used for GPS launches, the Delta II. Forty-one GPS satellites, which includes ten Block I systems, have launched since the programs inception in 1978.⁷⁵ Using the average of the cost range associated with the Delta II rocket of \$55 – 60 million, launch cost alone is currently at \$2.36 billion.⁷⁶ The Iridium system has approximately 2.3 times the number of on-orbit satellites and costs an estimated \$7 million per month to maintain.⁷⁷ Given GPS' achievement of full operational capability in mid-1995 and adjusting for the difference in GPS/Iridium constellation size, on-orbit maintenance cost is estimated at \$310 million and counting as of December 2003.⁷⁸

⁷⁵ Aaron Reneger, "Global Positions System celebrates 20 years of service," AFMC News Service #98-3-20, available from <http://www.fas.org/spp/military/program/nav/03-23-98.htm>; Internet; accessed 26 January 2004.

⁷⁶ National Aeronautical and Space Administration, NASA JSC Cost Estimating and Models Web Site; accessible through <http://www.jsc.nasa.gov>, NASA-JSC web site, then 'site map', then 'cost estimating'; direct link http://www.jsc.nasa.gov/bu2/ELV_US.html will not work; Internet; accessed 26 January 2004.

⁷⁷ Corey Grice, "Iridium owners optimistic about new satellite focus," CNET News.com, 12 December 2000; available from <http://news.com.com/2100-1033-249798.html?legacy=cnet>; Internet; accessed 27 January 2004.

⁷⁸ US Coast Guard Navigation Center, "What's the Status of GPS?," available from <http://www.navcen.uscg.gov/faq/gpsfaq.htm>; Internet; accessed 27 January 2004.

These figures put the cost of fielding the GPS capability at just under \$2.7 billion exclusive of the R&D costs that began in 1963 or satellite construction costs.⁷⁹ By comparison, the Army spent zero dollars in GPS Research, Development, Testing, and Evaluation (RDT&E) in fiscal year (FY) 2002. However, the Army does estimate spending \$5.89 million between FY 04 and FY 06 to increase the functionality and performance of its receivers.⁸⁰ Using the highest cost, commercially available GPS receiver⁸¹ as a benchmark price and the estimated 100,000 hand-held and vehicular mounted systems in use by the Army,⁸² the Army's fielding cost reaches \$55 million. The total Army cost estimate through FY 09 of \$60.9 million does not include original receiver R&D costs. However, the GPS space platform cost of \$2.7 billion does not include satellite R&D and procurement, an arguably high number, by the Navy and Air Force dating from before 1960.⁸³ The result of this cost estimate shows that with respect to GPS, the Army, using the leverage option, bought a \$2.7 billion capability for \$60.9 million.

This cost analysis demonstrates this option's feasibility and acceptability. The GPS example also supports suitability. GPS use in the Persian Gulf War for desert navigation and its expansion to precision munitions during Operation Iraqi Freedom is testament to having the right resources at the right time. However, the GPS example also provides an argument against this option. What would have happened if the Navy had developed a non-space method to locate its submarines? GPS might not have been available for U.S. ground forces in 1991 or at full

⁷⁹ AFSPC News Service, "Global Positions System marks 20th anniversary," available from http://www.fas.org/spp/military/program/nav/n19980225_980226.html; Internet; accessed 26 January 2004.

⁸⁰ Department of the Army, Office of the Secretary of the Army (Financial Management and Comptroller), "Supporting Data to FY 2004 President's Budget Submitted to OSD- February 2003, Army Appropriation, Budget Activities 4 and 5," Army RDT&E budget item justification (R-2 Exhibit), PE no. 0604778A, project 168, item no. 114, page 1 of 6.

⁸¹ The GPS Store – All handheld GPS units from Garmin®, Magellan®, Lorcance® and more, available from http://www.thegpsstore.net/gps_units_handheld.asp; Internet; accessed 26 January 2004.

⁸² AFSPC News Service, "Global Positions System marks 20th anniversary," available from http://www.fas.org/spp/military/program/nav/n19980225_980226.html; Internet; accessed 26 January 2004.

⁸³ Ibid.

operational capability in time to develop the weapons used in 2003. This demonstrates the risk inherent in outsourcing Army space capability to another Service with a focus different from land warfare dominance. Cost benefit is the major advantage to the leverage strategy. Dependence on the developmental needs of another Service for satisfying future Army needs is the major disadvantage.

Option 2: Focus on Ground Nodes

The second option is focusing on action against ground nodes to conduct space control. Enemy space-based capabilities require control from, and receipt by, a node on the ground. Because the Army excels in land warfare dominance, it is a logical course of action for the Army to focus its resources on the use and development of terrestrial capabilities. Within the construct of this option, use and development are limited to capabilities able to interdict an enemy's space-derived support at its ground nodes, command and control (C2), or end user. Targeting and attack system selection processes are more difficult for a mobile end user or C2 node, therefore, this option dictates the focus of limited Army resources for space control be on developing the capability to effectively find and attack mobile nodes.

This option is feasible as a logical extension of the current capabilities available to the combatant commander and therefore fits within available resources. It is suitable as removing the ability of the enemy's ground segment to send or receive data from the space segment accomplishes the mission of denying the enemy access to space or attacking those assets that threaten ours. Acceptability, being worth the cost or risk, is less clear or, at least, situation dependant. If the nation is at war and the enemy owns and controls the ground nodes, this option easily meets acceptability criteria. However, it is not as clear when no state of war exists. Is it politically acceptable to strike ground nodes before a declared state of hostilities? What if an enemy's space-based capability is imagery passed through diplomatic channels by a third party? Is interdiction acceptable, both politically and legally?

Terrestrial-based space control, for the purposes of this monograph, will stay true to the direction derived from the Taylor and Rupp article.⁸⁴ It is narrowly defined as action against enemy ground nodes. CDR Jon F. Berg-Johnson's view demonstrates the argument against this option's acceptability.⁸⁵ This paper provides a useful model for describing terrestrial-based control actions using the categories of direct, indirect, and deceptive action.⁸⁶ His use of direct action is in the kinetic vein and therefore "more than likely means entering the oppositions territory or possibly a collaborative belligerent's territory."⁸⁷ This statement must expand to include third party nations and entities if the collaborator is a corporation or consortium providing space-based capabilities. Berg-Johnson's indirect category speaks to the non-kinetic form of attack and is qualified by the requirement for force establishment in the theater of operations.⁸⁸ His deceptive category would, if better defined, include passive action to deceive an enemy's space-based collection assets such as minimizing communications footprints or creating false signatures and the use of camouflage and decoys.⁸⁹ The key elements affecting the terrestrial option then become the limitation that the ground node must be within range of Army detection and delivery systems, and engagement must be politically acceptable. Once established in theater, nodes within the defined operations area will most likely meet these criteria. The primary risk associated with this option is that denying the enemy access to space may be beyond the Army's ability to execute until the necessary capabilities are in the theater. Long-range interdiction is an option with the help of Navy and Air Force assets. However, this may cause an

⁸⁴ Dean Taylor, LTC and Daniel Rupp, CW4, "Start Line: Targeting an Adversary's Space Capabilities Begins with the Terrestrial Segment," *The Army Space Journal* 2, no. 2 (summer 2003): 18-19, 46.

⁸⁵ Jon F. Berg-Johnson, CDR, "Space Control: The Operational Commander's Future Dilemma," Department of Joint Military operations requirement, Naval War College (1994), 16-18.

⁸⁶ Ibid.

⁸⁷ Ibid., 17.

⁸⁸ Ibid.

⁸⁹ Ibid., 18.

undesirable second-order effect. If a state of hostilities does not yet exist, this action may escalate the conflict before the U.S. is fully prepared.⁹⁰ Another possibility is that, for example, the imagery node identified for destruction is also the communications node needed for exploitation. Further complicating the decision to act is the possibility that the critical node may belong to a third party that is legally providing a space-based capability to the adversary, and such action may be politically unacceptable. Non-lethal means may provide an answer but, again, asset location and range are an issue. This issue is resolved if one of the other Services has a jamming capability forward-deployed and its use against an Army concern fits within that Service's priority of use.

This second option is, therefore, acceptable with conditions. It carries the risk that space control capability will not be available until after deployment. Deception operations are required to negate enemy space-based collection efforts until lethal and non-lethal capabilities are operational within the area of operations. This option's major advantage is that the Army can leverage its own expertise in land warfare dominance to effect space control from in-theater, terrestrial-based platforms against the enemy's space system ground segment. A major disadvantage is the lack of active space control capabilities during deployment to deny enemy collection on point of debarkation (POD), point of embarkation (POE), and in-theater reception, staging, onward movement, and integration (RSOI) activities. Joint capabilities, assuming their existence or availability, mitigate this shortfall.

Option 3: Internal Development

The third option is an Army-centric approach to space control. It involves the allocation of resources to develop Army-required space control capabilities independent of the other Services, if the current joint processes do not meet those requirements. This option's premise is divisible into more simplistic steps. Once identified, Army requirements determine the needed

⁹⁰ Ibid., 17.

capability. This need is then submitted through joint processes to compete for DoD resources. If Army needs are not met due to fiscal constraints or priority issues, the Army develops the capability independently or bilaterally using a cradle-to-grave approach. This option is acceptable as addressing the needs of the warfighter is certainly worth the cost. It is suitable, as meeting space control needs independently when other options fail to solve the Army's problem and accomplish the mission directed by DODD 5100.1. As a reminder, this directive requires the Army "interdict" and "organize, train, equip, and provide forces for...space operations unique to the Army."⁹¹ The question concerning this option revolves around its feasibility.

The Army's total obligation authority for FY 2004 is \$93.9 billion and includes \$19.9 billion for procurement and RDT&E.⁹² An Army investment on the scale of the GPS space and ground segments would represent roughly 14% of the FY 04 procurement and RDT&E budget. This sizeable percentage would require the Army to reorganize overall spending priorities or "accept degradation in future force capability."⁹³ The GPS costs did not occur in a single fiscal year; they occurred over 25 years. This yearly cost represents 0.6% of the FY 04 procurement and RDT&E total obligation authority. These figures provide only a perspective, as not all costs, such as the actual cost of the GPS satellites, were included. In addition, twenty-five years may be too long to wait for a capability, and decreasing this timeline will increase the cost and percentage of the annual budget. Furthermore, the Army's space control needs may not involve the requirement for a space segment that is, arguably, the most costly segment to bring to full operational capability. However, from this perspective, if the capability needed by the Army

⁹¹ Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 17-18.

⁹² Department of the Army, Army Public Affairs, "Release #R-03-006: The Army Budget Fiscal Year 2004," (February 2003), available from <http://www.asafm.army.mil/budget/fybm/FY04-05/greentop.pdf>; Internet; accessed 28 January 2004.

⁹³ John M. Urias, BG, "Space Technology and Concept Development for the Army's Future Force," *Army Magazine* (December 2003): 33-36.

requires a cradle-to-grave approach involving unilateral development of all three space system segments, this option is feasible given enough time between capability identification and need.

The major advantage to this option is that the expert in land warfare dominance is developing and fielding those systems needed to maintain that dominance. BG Robert P. Lennox, Deputy Commanding General – Operations, Army Space and Missile Defense Command, supports this position. His article proposes that a Service not focused on land warfighting dominance cannot adequately develop space-based capabilities unique to land warfare.⁹⁴ He continues with the statement “Terrestrial-based space control for land warfighting dominance is in the Army domain, and should be an Army mission.”⁹⁵ This statement, unlike Option 2, is not limited to the attack of ground nodes. By expanding the Army’s space control role to include actions “from the land”; the Army can conduct space control against any space system segment.⁹⁶ This provides a responsive, flexible capability to the combatant commander.

A major disadvantage to this option is that in a fiscally constrained environment, even a relatively small reallocation of funds can cause major adjustments with respect to the development and fielding of other systems however, mitigation to these adjustments is possible. Failure to achieve joint funding does not necessarily mean the requirement has no joint merit. It could simply be a result of priorities determined by the Executive Agent for Space. Cost sharing with one or more of the other Services outside of the joint funding system or partnership with other government agencies or commercial enterprises mitigates the cost burden. The arrangement need only be reciprocally beneficial to the degree that it is worth investment of potential partner's dollars toward its creation.

⁹⁴ Robert P. Lennox, BG, “Newcomer’s View: Space-based capabilities critical to warfighter’s ‘seeing, understanding and acting first’,” *The Army Space Journal* 2, no. 2 (summer 2003): 4-5, 53.

⁹⁵ *Ibid.*, 5.

⁹⁶ Department of Defense, Department of Defense Directive 5100.1: Functions of the Department of Defense and Its Major Components (August 2002), Certified Current as of November 2003), 18.

The following table summarizes each option's ability to meet feasibility, acceptability, and suitability requirements.

	Leverage Option	Ground Option	Develop Option
Feasible	No major R&D. Easily fits within available resources.	Ground attack fits within available resources	Potentially cost prohibitive. Requires early identification of need to spread cost over several years.
Acceptable	Highly cost effective. Low risk except to capability timeliness.	Acceptable with conditions. Imparts high risk either politically for preemptive strikes or to initial-entry forces targeted by space-based ISR if the nodes are beyond the Army's operational reach.	Acceptable. Ensures warfighter access to space and enhances force protection.
Suitable	Accomplishes the mission only if another Service's efforts support yet-to-be-determined Army needs.	Acceptable with conditions. Imparts high risk either politically for preemptive strikes or to initial-entry forces targeted by space-based ISR if the nodes are beyond the Army's operational reach.	Accomplishes the mission through negation and protection. Encompasses all space system segments.

Figure 1. FAS Analysis Summary

By clearly defining the three options for Army space control roles, each option is feasible, acceptable, and sustainable. However, the bolded boxes in the table highlight that each option has difficulty or a weakness in meeting a different element of FAS. Mitigation is required to enable each option to meet feasibility, acceptability, and suitability criteria. The next chapter focuses on evaluating the options against their ability to meet Army needs during the early phases of a fictional scenario. The ability of each option to overcome the inherent weaknesses highlighted in Figure 1 weighs heavily in the option analysis.

Criterion Development

A detailed development of the criteria is necessary to ensure understanding of the context and purpose of the doctrine used in the evaluation and how the chosen doctrinal criteria apply in the evaluation. The criteria selected for evaluation are: 1) Unity of Effort, 2) Initial-entry Lethality and Survivability, and 3) Non-lethal Capability and Information Superiority. The following paragraphs will define each, explain the key elements, and establish how those elements factor into the evaluation of the presented options.

Unity of Effort

Unity of effort is a joint warfare fundamental in JP 1-0⁹⁷ and a principle for military operations other than war and a consideration for multinational operations in JP 3-0.⁹⁸ Joint Publication 1-0 states that “unity of effort demands that all undertakings be directed toward achievement of common aims.” This fundamental requires a focus, defined at the highest level of command authority, and cooperation by and among all parties to achieve the stated strategic aim. JP 3-0, in discussing military operations other than war (MOOTW), requires “commanders to seek an atmosphere of cooperation to achieve objectives by unity of effort.” This publication uses unity of effort as a method to achieve unity of command in an environment where the military may not have the lead in the overall operation. JP 3-0 further states that “military commanders need to consider how their actions contribute to initiatives that are also diplomatic, economic, and informational.” Unity of effort within this context is more encompassing of all elements of national power in achieving the desired end state. As a consideration for multinational operations, unity of effort expands its inclusiveness outside U.S. objectives and

⁹⁷ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 1-0: Joint Warfare of the Armed Force of the United States (November 2000), III-9.

⁹⁸ Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Publication 3-0: Doctrine for Joint Operations* (September 2001), V-2, VI-3.

requires the support of other nations in obtaining a shared goal. While JPs 1-0 and 3-0 define unity of effort differently, there is a key common thread and similar purpose.

Unity of effort, regardless of the type of operation, requires a defined aim provided by a higher command authority and the support and cooperation of all sub-elements involved toward achieving that aim. The current aim concerning space resides in DoDD 3100.10, Space Policy, and the Executive Agent for Space announcement of the 2004 National Security Space Top Priorities. DoDD 3100.10 states that the primary DoD goal for space and space related activities is to provide “capabilities to ensure that the United States has the space power to achieve its national security objectives.” This document also provides the contributing goals of “sustaining a robust U.S. industry and...technological base.” DoDD 3100.10 lists nine space activities that contribute to U.S. security objectives. Given JP 3-14’s statement that “currently, there are no force application assets operating in space,” two of the listed activities are general in nature.⁹⁹ They provide support to the overall attainment of national security. The following table is an interpretation of how the remaining seven activities spread across the three relevant space mission areas.

Space Mission Area	Number of Listed Activities*	Percentage of All Activities
Space Support	1.0	14.3%
Space Force Enhancement	1.5	21.4%
Space Control	4.5	64.3%
Surveillance	0.5	7.1%
Protection	3.0	42.9%
Prevention	0.0	0.0%
Negation	1.0	14.3%

Figure 2. DoD Space Policy Activity Breakdown

* Some listed activities address more than one area. In these cases, partial and equal values are given to each affected mission area.

⁹⁹ Department of Defense, Department of Defense Directive 3100.10: Space Policy (July 1999), 7, para. 4.3.1.1 and 4.3.1.9.

The data in Figure 2 demonstrates a considerable weighting toward the space control mission area. The top five priorities for 2004 announced by the Executive Agent for Space are more holistic in nature than the specified activities in DoDD 3100.10. The five priorities are: 1) mission success in operations and acquisition, 2) integration of space capabilities for national intelligence and warfighting, 3) ensuring freedom of action in space, 4) development and maintenance of space professionals, and 5) production of innovative solutions for national security problems.¹⁰⁰ Success in operations applies equally to all space mission areas. Success in acquisition addresses the 1999 Space Policy contributing goals concerning the industrial and technological base. The integration of space capabilities speaks directly to space force enhancement. Freedom of action equates to assured access through the space support mission area and space control. The remaining two priorities discuss leader development and attributes (space professionals and the ability to find innovative solutions). The guidance provided by DoD's Space Policy and the Executive Agent for Space is the basis for the unity of effort evaluation. In general, each option for the Army's approach to space control is judged on its ability to meet specific space control aims and/or activities outlined in these two documents. Specifically, the evaluation of each option depends on its contribution to unity of effort toward joint space control and joint interdependence.

Initial-entry Lethality and Survivability

As part of strategic responsiveness, Army forces must be lethal and survivable.¹⁰¹ Lethality is the ability to combine the elements of combat power to defeat the enemy. Space control, through assured access or denial, supports or accomplishes all five elements of combat power: maneuver, firepower, leadership, protection, and information. FM 3-0 states, "From the

¹⁰⁰ The Honorable Mr. Peter Teets, Undersecretary of the Air Force, "2004 National Security Space Top Priorities: Challenges for Government and Industry Partners;" available from <http://www.safus.hq.af.mil/docs/priorities/pdf>; Internet; accessed 28 January 2004.

¹⁰¹ Department of the Army, *Field Manual 3-0: Operations* (June 2001), 3-1.

operational and tactical perspectives, commanders ensure deployed Army forces have enough combat power to overwhelm any likely enemy.” Specifically, FM 3-0 charges commanders to tailor force packages to maximize the lethality of initial-entry forces.” The field manual further states “Initial-entry forces require enough combat power to establish and protect lodgments and begin simultaneous shaping operations immediately upon arrival.”¹⁰² Survivability, as defined by FM 3-0, is the combination of technology and methods to afford the maximum protection.¹⁰³ Protection is the preservation of the fighting potential and consists of four components; force protection, field discipline, safety, and fratricide avoidance.¹⁰⁴ According to FM 3-0, force protection includes air, space, and missile defense as well as defensive information operations.¹⁰⁵ The key element of lethality and survivability concerning space control is sufficient resources made available to initial-entry forces to enable establishment and protection of lodgments and immediate initiation of shaping operations. These resources must also provide sufficient space and information defense to ensure the preservation of the fighting potential. The evaluation of the three options is with respect to their ability to provide deploying Army forces with the space control capabilities necessary to protect the force and to begin to shape the battlespace for follow-on forces. Specifically, the evaluation of the options depends on their ability to provide lethal negation and to increase overall force lethality. For survivability, the options are evaluated on their ability to ensure space system and ground force survival.

Non-lethal Capability and Information Superiority

The final evaluation criteria are two supporting competencies of the Army’s Core Competency of sustained land dominance (precision fires and maneuver and information

¹⁰² Ibid., 3-6.

¹⁰³ Ibid., 3-4.

¹⁰⁴ Ibid., 4-8

superiority).¹⁰⁶ The Army engages “an enemy, directly or indirectly, with lethal and non-lethal means, through the synergistic application of precision fires and maneuver.”¹⁰⁷ The non-lethal means is the focus for use of this criterion. The term non-lethal, for the purpose of this evaluation, is synonymous with non-persistent or reversible. This is an important factor given the proliferation of third-party space-based products and services and the legal issues concerning sovereignty and free trade created by physical destruction. Physical destruction of ground-based systems may also increase the cost of post-conflict operations depending on the economic and social significance of the system destroyed. Exoatmospheric physical destruction increases the risk to U.S. space systems through increased debris and likelihood of retaliation.

Information superiority is “that degree of dominance in the information domain which permits the conduct of operations without effective opposition.”¹⁰⁸ FM 1-0 declares, “Information superiority is essential to decisive Army operations.”¹⁰⁹ This publication also asserts that information operations (IO), conducted through means including space-based capabilities, “affect an enemy’s will to resist” and provide the U.S. decision superiority.¹¹⁰ Using these definitions and capabilities, the information superiority element of the criteria is the ability through space control to provide Army forces with responsive situational understanding and to deny an enemy the ability for the same. It also denies the enemy the ability to use information systems to strengthen their position or counter U.S. efforts to weaken that position.

¹⁰⁵ Ibid.

¹⁰⁶ Department of the Army, *Field Manual 1-0: The Army* (June 2001), 23.

¹⁰⁷ Ibid.

¹⁰⁸ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms (April 2001, as amended through January 2002), 211.

¹⁰⁹ Department of the Army, *Field Manual 1-0: The Army* (June 2001), 23.

¹¹⁰ Ibid.

The key elements of this criterion are: 1) temporary, effective negation of enemy space-based capabilities linked to the operational design of the Joint Force Land Component Commander (JFLCC), 2) the ability to retain access to those systems providing information for the common operating picture, and 3) gaining or maintaining the ability to influence, in theater, an adversary's support base. Each option is evaluated for its ability to ensure the Army has a responsive capability to execute these key elements in theater in support of the Joint Force Commander (JFC) and the JFLCC. Responsiveness of effects, as well as the existence of the capability, is critical to future land operations and the sustainment of land dominance.

CHAPTER 4

OPTION ANALYSIS AND CRITERIA EVALUATION

This chapter analyzes each option for Army space control roles utilizing the criteria introduced in Chapter 1 and developed in Chapter 3. The aim of this analysis is to determine which option best meets the needs of the Army. The chapter develops and presents a scenario upon which the criteria are applied. The developed scenario contains both state and non-state actors in order to incorporate the unique challenges posed by the contemporary operating environment. Next, the evaluation of each option against the three criteria within the context of the scenario is provided. The chapter concludes with a summary of the strengths and weaknesses of each option.

Scenario Development

The purpose of developing a scenario for use in option evaluation is to provide a framework that incorporates the Army's transformation toward a "more relevant and ready, campaign-quality Army with a Joint and Expeditionary Mindset."¹¹¹ Additionally, scenario creation provides the ability to evaluate options for a transforming Army against the state and non-state adversaries found in the contemporary operating environment. The postulated scenario enables evaluation of each option against a likely set of adversaries in the context of a joint and expeditionary force. The scenario consists of the first two of the four phases described in JP 3-0 under the "Arranging Operations" facet of operational art.¹¹² The four phases are deter/engage,

¹¹¹ Department of the Army, Chief of Staff, "U.S. Army: The Way Ahead," Army Strategic Communications, Washington, DC, December 2003, 1, available from <http://www.army.mil/thewayahead/foreword.html>; Internet; accessed 15 February 2004.

¹¹² Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Publication 3-0: Doctrine for Joint Operations* (September 2001), III-17 – III-21.

seize initiative, decisive operations, and transition.¹¹³ Phasing the scenario and developing space control requirements for those phases provides a framework upon which to evaluate Army space control needs from initial-entry through preparation for decisive action. Capability availability to individual Services is critical during these phases as joint capability is at its most austere level and Service success is necessary to set the conditions for overall joint force success.

Before describing the parameters of the scenario, it is necessary to define the overall characteristics of the Army that will be fighting in this environment. The two key terms used to define the transformed Army are joint and expeditionary. Joint interdependence is “the Joint Team’s greatest asset.”¹¹⁴ This term indicates an elimination of redundant capabilities among the Services. Each Service is responsible to bring a needed capability to the fight and, since no Service is self-sufficient, all Services are necessary to ensure U.S. military success. Interdependence is not yet in its final form. The Army’s *Relevant and Ready* booklet states “we must examine all the capabilities resident in the Joint Force and determine the Service best positioned to provide that capability to the Combatant Commanders.” Therefore, the transformed Army must be prepared to enter the theater of operations dependant upon capabilities not resident, or no longer resident, in its own force structure. As such, other Services provide needed capabilities for successful Army operations. The second term requiring definition is “expeditionary”. The National Security Strategy calls for “transformed maneuver and expeditionary forces.”¹¹⁵ JP 1-02 defines expeditionary as “an armed force organized to accomplish a specific objective in a foreign country.”¹¹⁶ The Army Chief of Staff has equated

¹¹³ Ibid., III-19.

¹¹⁴ Ibid., 4.

¹¹⁵ President, Policy Statement, “The National Security Strategy of the United States of America (September 2002): 30; available from <http://www.whitehouse.gov/nsc/nss.pdf>; Internet; accessed 22 February 2004.

¹¹⁶ Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms (April 2001, as amended through January 2002), 158.

expeditionary with agility and the ability to arrive in theater more quickly.¹¹⁷ Quickly is defined in the *Relevant and Ready* booklet as deployment within the first fifteen days of an operation.¹¹⁸ The expeditionary Army “must...reflect greater versatility and deployability, while ensuring the necessary capabilities to conduct both sustained combat and potentially simultaneous operations to re-establish stability.”¹¹⁹ Another aspect of expeditionary from this booklet is modularity. The expeditionary mindset “embraces a forward leaning, modular, joint interdependent, and capabilities-based Army.”¹²⁰ The transformed Army improves its contributions to the joint force “by developing more modular, strategically responsive organizations.”¹²¹ The scenario reflects the early deployment of an Army force built specifically for the particulars of the described theater of operations. This Army force accepts the risk of not being self-sufficient and mitigates this risk with the joint capabilities provided by other Services. This force, however, must deploy with sufficient capability to reflect the limited scope of the initial joint force.

The adversary in the developed scenario consists of a nation-state with the ability to leverage non-state actors. This is consistent with the National Security Strategy statement that the United States’ primary enemies are “shadowy networks of individuals” and the nations’ gravest danger “lies at the crossroads of radicalism and technology.”¹²² The National Security

¹¹⁷ Peter J. Schoomaker, GEN, 35th Chief of Staff of the Army, “Security Planning and Military Transformation After Iraqi Freedom” (CSA Remarks (As Delivered): The 34th IFPA-Fletcher Conference on National Security Strategy and Policy, Washington, D.C., December 3, 2003); available from <http://www.army.mil/leader/csa/speeches/20031203.html>; Internet; accessed 31 January 2004.

¹¹⁸ Department of the Army, Chief of Staff, “U.S. Army: The Way Ahead,” Army Strategic Communications, Washington, DC, December 2003, 11, available from <http://www.army.mil/thewayahead/foreword.html>; Internet; accessed 15 February 2004.

¹¹⁹ Ibid., 6.

¹²⁰ Ibid., 4.

¹²¹ Ibid., 9.

¹²² President, Policy Statement, “The National Security Strategy of the United States of America (September 2002): i-ii; available from <http://www.whitehouse.gov/nsc/nss.pdf>; Internet; accessed 22 February 2004.

Strategy requires that “the United States must and will maintain the capability to defeat any attempt by an enemy – whether a state or non-state actor – to impose its will on the United States, our allies, or our friends.”¹²³ The potential for conflict in the following scenario supplies other, non-aligned nations a low-risk opportunity to gain or increase influence in the region and, therefore, covert and passive political support to the adversary is expected. This support takes the form of commercial and national imagery, communications support, space tracking information, and political action or inaction in United Nations debates.

Scenario

With the adversary type and transformational Army defined, the scenario focuses on the first two phases of an operation as provided by JP 3-0; deter/engage and seize the initiative.¹²⁴ The focus of the evaluation is on these early phases because the full compliment of joint force capability is not yet present. Full spectrum dominance is present or anticipated in Phase III, decisive operations, and Phase IV, transition. The initial-entry space control needs of an expeditionary Army are most pertinent to this monograph.

Enemy Situation

The enemy is a nation-state with linkages to transnational terrorist organizations. It provides support for terror organizations and is willing to utilize the capabilities of these organizations in concert with more conventional military operations. The enemy seeks to improve its own regional status while simultaneously forcing a reduction in U.S. influence through coercion against other regional states, economic influence, and populous support for anti-U.S. policies throughout the region. The enemy has significant theater ballistic missile (TBM)

¹²³ Ibid., 30.

¹²⁴ Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Publication 3-0: Doctrine for Joint Operations* (September 2001), III-19, III-20, III-21.

capability and can range historical U.S. force projection platform locations in the region. This adversary has successfully conducted an information campaign to convince the regional populace that current economic woes and erosion of ethnic standing are a result of support for U.S. policies by other regional nations. The enemy believes the time is right to force other regional nations to expel U.S. presence. It realizes the key to success is to prevent a successful build-up of U.S. force presence and to demonstrate U.S. vulnerability to the region's populace. This, in concert with military and terrorist pressure, will increase populace fervor and force the other regional nations to capitulate.

Friendly Situation

The increase in tension threatens to undermine U.S. efforts in the region to “expand the circle of development by opening societies and building the infrastructure of democracy”, “to diffuse regional conflict”, and “to strengthen alliances to defeat global terrorism.”¹²⁵ Force projection platforms are limited for the U.S., as public opinion in the affected region does not support an increased presence of U.S. forces. The U.S. must diffuse the negative populous sentiment, quickly enter the theater of operations with minimal presence, exert effective diplomatic, informational, and military influence to stabilize those governments friendly toward U.S. policies, and negate the threat from the adversary to its neighbors. Initial, small-footprint ground forces are necessary to deter further aggression by demonstrating U.S. resolve and to ensure theater access should deterrence fail. The key for U.S. success is to quickly build initial combat power, protect those forces from enemy interdiction, conduct successful information operations to reshape regional public opinion, and prepare the theater for full joint force entry.

¹²⁵ President, Policy Statement, “The National Security Strategy of the United States of America (September 2002): Table of Contents; available from <http://www.whitehouse.gov/nsc/nss.pdf>; Internet; accessed 22 February 2004.

Phase I: Deter/Engage

According to JP 3-0, “this phase may be for deterring aggression or taking action against threats to national or multinational interests.”¹²⁶ This publication further states “Intelligence, surveillance, and reconnaissance (ISR) assets are employed during this phase to provide real-time and near-real-time situational awareness.”¹²⁷ Decisive to this phase is the protection of U.S. lodgment areas and critical host nation infrastructure. Additionally, the U.S. must quickly achieve battlespace awareness. U.S. access to ISR and denial of the same to the enemy is critical to the protection of U.S. initial-entry forces. The U.S. must ensure the required force package arrives in theater in order to demonstrate commitment to supporting friendly governments and to convince the enemy that aggressive behavior ensures its defeat. To this end, the U.S. force package avoids successful targeting by terrorist forces and the enemy’s TBM forces. Additionally, the force has access to capabilities that allow the conduct of information operations to reshape public opinion and perception.

Phase I Space Control Requirements

From the scenario, certain space control capability requirements can be derived. The limited bases available to the U.S. require the ability to deny the enemy the capability to observe activity at those sites. Kinetic action against neutral party space-based ISR would escalate the conflict and may be politically unacceptable. Initial-entry forces require the in-theater capability to temporarily negate third-party space-based ISR. These forces must have the flexibility to negate any or all of the space system segments providing targeting and intelligence data to the enemy. The vulnerability of U.S. lines of communication to terrorist interdiction threatens force sustainability. While terrorist command and control (C2) nodes within friendly nations may be

¹²⁶ Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Publication 3-0: Doctrine for Joint Operations* (September 2001), III-19.

¹²⁷ *Ibid.*, III-20.

kinetically targeted, kinetic targeting of those same type of nodes within the enemy's national boundaries, at this point in the scenario, are either politically unacceptable or more useful to exploit than destroy. The initial-entry force requires in-theater, responsive tasking of overhead signals and electronics intelligence assets. It requires the flexibility for both temporary and permanent negation of enemy C2 and the ability to monitor it. Kinetic strikes that are required and authorized must be precise as any collateral damage enhances the enemy's IO campaign. Initial-entry forces require uninterrupted access to the GPS capability. Assured access to space-based force enhancement systems increase lethality through reachback to lethal joint force capabilities, enables the achievement of battlespace awareness, and provides for the use of information dissemination systems to shape the region's public opinion. Finally, with respect to IO, it may be necessary for the initial-entry force to negate propaganda emanating from the enemy nation-state. However, this broadcast system must be preserved as it is beneficial to Phase IV transition operations to "establish civil control and rule of law."¹²⁸ The initial-entry force requires the ability to selectively disrupt certain segments of the electro-optical (E-O) spectrum through non-lethal means.

Phase II: Seize the Initiative

During this phase, forces conduct offensive operations "at the earliest possible time, forcing the adversary to offensive culmination and setting the conditions for decisive operations."¹²⁹ Theater access and force protection operations continue from phase I and the joint force "seeks to degrade adversary capabilities."¹³⁰ Decisive to this phase is the attainment of information superiority and freedom of maneuver. As initial-entry forces operationally maneuver, battlespace awareness increases in importance. More kinetic systems are available at

¹²⁸ Ibid., III-19.

¹²⁹ Ibid., III-20.

¹³⁰ Ibid. III-21.

the same time as non-lethal means of attack are less decisive. The increase in the size of the joint force requires the initial-entry force to have assured access to communications assets and systems that are interoperable with other joint force elements. Theater ballistic missile defense (TBMD) continues to be critical to the survivability of the joint force and the stability of host nation support. As the conflict moves toward a higher intensity of combat, the likelihood of TBM employment also increases. Initial-entry forces must be able to negate or mitigate this threat.

Phase II Space Control Requirements

Assured access and the linkage of sensor to firepower are the key elements of this phase. Phase II ground forces must have access to the ISR systems that enable TBM launch detection, targeting, strike, and enable the population of the common operating picture. Negation of enemy ISR remains critical from phase I as it enables operational maneuver into a position of advantage without enemy targeting. Phase II ground forces also require the ability to negate TBM guidance and launch C2. These ground force capabilities, during phase II, begin to augment overall joint force space control and IO efforts. Information operations continue to shape regional and global public opinion. Phase II forces require access to the means to disseminate IO themes into the enemy state to begin to erode his public support.

Option Evaluation: Option 1, Leverage the Efforts of Other Services

Unity of Effort

The leverage option fails to contribute to unity of effort toward joint force space control. However, by depending on other sources of development it does succeed in contributing to the unity of effort to create joint interdependence. Unfortunately, joint interdependence exists, in this sense, only through the possibility of no Army or initial-force space control capability. It fails to contribute to joint force space control because it is a passive approach. General Schoomaker's description of joint interdependence involves the Army providing the joint force with unique and

complimentary capabilities.¹³¹ Leveraging does not support the development of unique space control capability. Leveraging enables complimentary capability but a window of no capability exists because of the lag between development and adaptation.

The window of no capability may be unacceptably long. For the postulated scenario, the requirements for in-theater, non-lethal, temporary negation of space-based ISR is critical in both phase I and II. In-theater port facilities and initial-entry force concentrations are vulnerable to interdiction if located by the enemy. Leveraging requires the other members of the joint team to develop this capability so it can be adapted for use by the ground force. The Navy is concerned with overhead collection but with a focus different from that of the ground force. It is a force in motion and not directly tied to a fixed infrastructure. While the ground force is vulnerable to all forms of collection, its focus is on E-O collection because, like the Navy, it can employ deception and denial to negate the other forms. E-O collection while at sea is a lesser concern for the Navy than electronics emission collection. The size of the Navy's maneuver space and lack of timeliness concerning E-O collection and dissemination, especially commercial, does not provide the necessary impetus for E-O negation capability development. Electronics emission collection can be negated through denial and deception techniques without the need to directly attack the collector. There is more merit for the Navy to develop counters to signals and electronics collection than E-O and, therefore, the time necessary for the leverage option, with respect to Navy capability development, is unacceptable.

The Air Force is also moving toward an expeditionary force and focuses on both air and space. Efforts to upgrade their aerial refueling tanker fleet demonstrate a commitment to "long haul" missions. The Air Force is also dependant upon fixed infrastructure (airfields). However, as an expeditionary force structure is achieved with basing further from the theater of operations,

¹³¹ Department of the Army, Chief of Staff, "U.S. Army: The Way Ahead," Army Strategic Communications, Washington, DC, December 2003, 4, available from <http://www.army.mil/thewayahead/foreword.html>; Internet; accessed 15 February 2004.

E-O negation lessens in importance. Of the three Service Departments, the Army has the driving need for in-theater, non-lethal, E-O overhead collection negation. If the Service with the greatest need waits to leverage a capability with lower priority in the other Services, it is unlikely the capability will exist when needed. Similar arguments concerning priority of effort or need are relevant for the other space control requirements developed from the scenario. This does not mean the capabilities are not desirable for all Services. It simply reflects the reality that each Service places a different priority on their development.

Initial-entry Lethality and Survivability

The leverage option is acceptable concerning the development of lethal negation and survivable space systems. Lethal negation of ground nodes is an existing capability available from all members of the joint team. Lethal negation of space platforms is better suited for the Air Force. The Army invested in the research and development of kinetic energy, anti-satellite capabilities (KE-ASAT).¹³² However, given the threat an increased debris field poses to orbiting systems already operated by the Air Force, this is an area better served by the leverage approach for the Army. The Air Force has a better situational understanding of when to employ such a system for maximum effect and minimal collateral damage. The Air Force prioritized the protection or survivability of space platforms with its ongoing research and development of the Rapid Identification, Detection, and Reporting System (RAIDRS).¹³³ Therefore, space system survivability is also well served by a leverage approach.

The shortfall of the leverage option occurs in the areas of ground force lethality and survivability for the reasons given under the unity of effort section. Space control is an enabler of

¹³² Brett Davis; "Army satellite-killing program gets \$3M," The Huntsville Times, 11 October 2000, available from <http://www.cndyorks.gn.apc.org/yspace/articles/asat4.htm>; Internet; accessed 21 February 2004.

¹³³ Jeremy Singer, "USAF Aims to Neutralize Anti-Satellite Weapons", *Defense News*, 02 February 2004.

ground force lethality through assured access to ISR and precision guidance. Recent fielding developments concerning improved GPS capability provide a further example of a shortfall in lethality. Precision guidance is enabled by assured access to the GPS signal. The next generation of GPS satellites, GPS III, incorporates new capabilities including the ability to overcome enemy jamming.¹³⁴ Efforts to accelerate the fielding were unsuccessful and a later launch schedule accepted.¹³⁵ While all the services utilize precision munitions, the Army is the most affected by less precise munitions caused by GPS jamming. The leverage approach leaves the decision process for a later fielding outside Army channels and demonstrates the risk in a purely passive approach to space control capability development. Sole Army focus on ground segment capability leaves little decision-making weight concerning the other segments. Ground force survivability shortfalls for the leverage option are tied directly to the inability to deny an adversary access to overhead collection assets as discussed under Unity of Effort.

Non-lethal Capability and Information Superiority

The scenario requires a non-lethal space control capability. This requirement is generated by enemy access to non-belligerent space-based capabilities and the political risk associated with lethal negation. The leverage option, as already demonstrated, is insufficient in providing this capability with respect to space-based collection. It is, however, a valid option with respect to information superiority. The Air Force flies and maintains the majority of space platforms used by the U.S. military. The assured access required to gain and maintain information superiority falls within the protection aspect of space control. Protection is accomplished, to a large degree, by the design and system specification implemented through space system acquisition processes under the purview of the Executive Agent within the

¹³⁴ Amy Butler, "Rumsfeld Abandons GPS III Acceleration, Approves FY '12 GPS III Launch", *Defense Daily*, 18 September 2003, 3, available from <http://ebird.dtic.mil/Sep2003/e20030918218022.html>; Internet; accessed 18 September 2003.

¹³⁵ Ibid.

Department of the Air Force. Additionally, other government agencies continue to develop and refine information requirements and capabilities. The leverage option is suitable in this area because of its extreme cost effectiveness and because the Army requirement for information is not unique.

Option Evaluation: Option 2, Physical Destruction of the Ground Node

Unity of Effort

The ground segment option marginally contributes to unity of effort toward joint force space control. In this option, the Army uses its dominance in land operations to locate and destroy the enemy's ground nodes where it receives, processes, and uses space-based capabilities. The contribution is marginal, however, because all members of the joint team possess the capability to locate and kinetically or non-kinetically engage a target. During phase I of the provided scenario, the other members of the joint team, due to weapon system and platform ranges, are better positioned to assume this function. Additionally, by limiting space control efforts to negation of ground systems, the Army is completely dependant upon other joint team members to find and negate enemy systems beyond the Army's operational reach. In this way, the option supports joint interdependence but at the risk of another's priority of effort. During phase I of the scenario, this priority equates to establishing air superiority and command of the sea. Even if sufficient joint force is available to devote effort to ground negations, the targets are multiple and fleeting. For the E-O threat described in the scenario, space platform negation presents fewer targets and easier location. Finally, if the reception and processing node is located in a non-aligned nation, even non-lethal action against a ground node risks conflict escalation.

Initial-entry Lethality and Survivability

The ground segment option meets the criteria for lethal negation but is subject to the aforementioned operational reach and political limitations. The lethal means already exist to

engage ground segments and therefore development would focus on locating targets.¹³⁶

However, Army location of targets is irrelevant if the means are not available to engage because of limits in operational reach. Additionally, the scenario-inferred distance from target location to delivery system requires a survivability emphasis on the space systems enabling non-line of sight data transmission. However, this option only marginally addresses space system survivability. The ground force can affect only those enemy negation systems within its operational reach. If the enemy's negation system, either kinetic or non-kinetic, is beyond the Army's operational reach, another member of the joint team must neutralize that system. These assets are limited during phase I of the scenario and the risk to Army access may not be sufficiently mitigated.

The ground option does not meet the force lethality criteria, as it does nothing to increase the existing capability. This option also does not meet the force survivability criteria during phase I and II of the scenario. The main threat during phase I is attack by TBM using targeting data obtained through space-based systems. A ground option would require the neutralization of the receiving and processing node that is outside the ground force's weapons range and/or the launch site of the TBMs using this targeting data that is also outside ground force range. While missile defense systems may succeed in protecting the force, ground node negation does not contribute to this capability.

Non-lethal Capability and Information Superiority

For the ground option to present a viable non-lethal capability, it must be persistent. Temporary negation of ground nodes is ineffective as it allows the enemy effective use of its systems for targeting while not negated. Unlike space platform negation that must occur only while a platform is within view and accomplished from friendly territory, negation of the ground node must occur whenever any usable space platform is in view and the negation system must be

¹³⁶ Dean Taylor, LTC and Daniel Rupp, CW4, "Start Line: Targeting an Adversary's Space Capabilities Begins with the Terrestrial Segment," *The Army Space Journal* 2, no. 2 (summer 2003): 46.

elevated and directed. This option is therefore impractical due to operational reach and the number of targets. The ground option does enhance information superiority within the limits of operational reach. While this option does not increase U.S. informational capability, it can effectively decrease the enemy's capability. This somewhat indirect approach to increasing the capability gap creates relative information superiority.

Option Evaluation: Option 3, Army-centric Capability Development

Unity of Effort

Army development of a space control capability without coordination or consultation amongst the joint team does not contribute to unity of effort toward joint force space control. The likelihood of a completely independent development program resulting in a capability seamlessly integrated into joint force architecture after fielding is very low. Development, in line with joint goals and aims, mitigates the risk of non-interoperability. The Army's KE-ASAT program provides a good example of how a lack of unity of effort wastes resources. The Army began its most recent ASAT effort in 1989.¹³⁷ The Air Force participation was limited to the command and control system for launch authorization and execution. The weapon system development and testing belonged to the Army. From 1996 – 1998, the Army spent \$98.9 million on development and testing. DoD's goals and priorities, however, were for temporary and reversible space control capabilities.¹³⁸ Sole Service ownership, in this case, resulted in ten years of effort and almost \$100 million expended with no delivered capability.

The Army development option does support unity of effort toward joint interdependence. Interdependence results in Service unique and complimentary capabilities. The key to success in

¹³⁷ Encyclopedia Astronautica, s.v. "KE ASAT", available from <http://www.astronautix.com/craft/keasat.htm>; Internet; accessed 21 February 2004.

¹³⁸ United State General Accounting Office, "GAO-01-228R KE-ASAT Program Status", Washington, D.C. (05 December 2000): 2, Enclosure 1 pg. 9, available from <http://www.globalsecurity.org/space/library/report/gao/d01228r.pdf>; Internet; accessed 22 February 2004.

this area, however, is common joint goals and aims. From the scenario and the discussion of the leverage option, non-lethal negation of overhead collection is a common joint goal. The type of collection assets and the priority of need, however, differ for each member of the joint team. For example, the Air Force characterizes offensive counterspace or, in joint terminology negation, as “currently the least urgent capability.”¹³⁹ This, of course, does not imply the Air Force does not recognize the need for negation. Unfortunately, for the Army in the developed scenario, this priority is incompatible with Army needs. Army investment in this capability fills a unique Service need that will compliment joint force capability as other members of the joint team work toward non-lethal negation within their unique priority framework.

Initial-entry Lethality and Survivability

The development option is not acceptable for all lethal negation. The KE ASAT program results support this contention. Lethal negation from the ground to space requires detailed coordination with air and space users in the affected area. Single-Service development of such a capability does not ensure joint force or even political will to use such a capability. Lethal negation of the ground segment within the operational reach of the ground force is an existing capability and is not, therefore, germane to this evaluation. Likewise, this option concerning space system survivability is uncontested. The Army owns and operates the in-theater, ground segments used in the scenario. Ensuring those segments are survivable is a current and ongoing effort by all Services utilizing space force enhancement products and services.

The development option meets the criteria for ground force lethality from two perspectives. First, the development of lethal, exoatmospheric negation adds to overall force lethality even if it does not meet the unity of effort criteria and risks political and joint team non-

¹³⁹ Department of the Air Force, Air Force Space Command, “Strategic Master Plan: FY 06 and Beyond”, Peterson AFB, CO (01 October 2003):23; available from <http://www.peterson.af.mil/hqafspc/Library/AFSPCPAOffice/Final%2006%20SMP--Signed!v1.pdf>; Internet; accessed 22 February 2004.

acceptance. Second, from the scenario, lethal destruction of enemy negation capability such as GPS jammers increases the lethality of ground force precision munitions. Elimination of enemy negation capability and space-based ISR increases ground force survivability through assured access and denial.

Non-lethal Capability and Information Superiority

The development option meets the criteria of non-lethal capability and information superiority. The scenario-derived capability requirements combined with real world priority of effort statements by the Air Force demand Army development of a non-lethal ISR negation system. This statement assumes a high probability that the U.S. will be involved in a conflict in which an enemy uses space-based capabilities to target U.S. forces prior to the 2017 Initial Operating Capability of the Air Force's non-lethal negation system.¹⁴⁰

This third option for an Army space control role marginally meets the information superiority criteria. Similar to the ground option, degradation of an adversary's informational systems widens the gap between force capabilities creating relative information superiority. As stated earlier, assured access is the key to attaining real superiority. It is, however, neither feasible nor acceptable for the Army to redesign and launch more survivable capabilities, as it will most likely never be the Executive Agent for Space. A development option does not address current access shortfalls and, without inter-service cooperation, fails to address future assured access difficulties.

Summary

The summary table on the next page indicates that, given the scenario and the criteria, the development option is the recommended course of action. The final values provided in the summary table, however, do not anoint the perfect solution. The scenario developed to drive the

¹⁴⁰ Ibid., 24.

assessment, while realistic, is not a template to all future conflict. The assessment highlights the shortfalls associated with a rote approach to space control by the Army. This assessment merely provides the framework upon which to build the next chapter's conclusions and recommendation.

<u>Criteria</u>	<u>Leverage</u>	<u>Ground</u>	<u>Develop</u>
Unity of Effort			
Joint Space Control	-1	0 ¹	-1
Joint Interdependence	+1 ²	+1 ²	+1
Initial-entry Lethality and Survivability			
Force Lethality	-1	-1	+1
Lethal Negation	+1	+1 ³	-1
Force Survivability	-1	-1	+1
Space System Survivability	+1	0 ⁴	+1
Non-lethal Capability	-1	-1	+1
Information Superiority	+1	0 ⁵	0 ⁶
Total	0	-1	+3

Figure 3. Analysis Summary

¹ The null value assigned to ground option joint space control is due to the current existence of targeting and engagement capabilities for ground segments by all members of the joint team. Pursuing a course of action limited to negation of ground nodes does not add significant value to the joint effort during phase I and II of the scenario.

² Joint interdependence for the leverage and ground options is met but only through complete dependence. During phase I and II, this dependence may create unacceptable risk.

³ The ground option receives a positive assessment for lethal negation with respect to ground node engagement but is subject to phase I and II operational reach limitations.

⁴ The ground option receives a null assessment for space system survivability because of phase I and II operational reach limitations. Unlike lethal negation, the enemy systems preventing access to space systems or kinetically targeting U.S. systems are, for the vast majority, beyond the reach of phase I and II ground systems.

⁵ The ground option receives a null assessment for information superiority because it is only able to affect relative superiority. It does not add to U.S. informational capability.

⁶ The development option receives a null assessment for information superiority. This option is neither feasible nor acceptable concerning assured access to space-based information enablers. However, the option's success in denying enemy ISR access does provide relative superiority.

RECOMMENDATIONS AND CONCLUSIONS

Clausewitz defined three cases of interaction and “extremes” to frame his theory of war.¹⁴¹ From these extremes defined by theory, reality lies somewhere short of the absolute. In the words of Clausewitz, “the probabilities of real life replace the extreme and the absolute required by theory.”¹⁴² This monograph discussed three extremes; options for Army space control involvement evaluated in isolation against a common set of criteria. This study answered the question of the necessity of Army investment in the affirmative through the determination of the appropriate level and type of Army involvement in the space control mission area. Like Clausewitz’s theory of war, the answer lies in the interstitial spaces between the absolutes of theory. The three absolutes presented are: 1) leverage the efforts of other services, 2) focus on ground node negation, and 3) develop and field capabilities within the Army. Evaluation of the options against unity of effort, initial-entry lethality and survivability, and non-lethal capability and information superiority yields an assessment that internal development and fielding of required capabilities best meet Army needs. The Army, however, is not constrained to follow one absolute course of action that, while the detractors are comparably less, still has flaws. The best solution for the Army is to incorporate the level of flexibility required to utilize the strengths of each option to reach the desired end state of joint force space superiority. In other words, construct a fourth course of action that follows the path of greatest benefit or least negative value.

¹⁴¹ Carl Von Clausewitz, *On War*, trans. and ed. Michael Howard and Peter Paret, 8th Printing (New York: Alfred A. Knopf, a division of Random House, 1993), 85-86

¹⁴² *Ibid.*, 89.

Criteria	Leverage	Ground	Development
Unity of Effort			
Joint Space Control	-1	0	-1
Joint Interdependence	+1	+1	+1
Initial-entry Lethality and Survivability			
Force Lethality	-1	-1	+1
Lethal Negation	+1	+1	-1
Force Survivability	-1	-1	+1
Space System Survivability	+1	0	+1
Non-lethal Capability	-1	-1	+1
Information Superiority	+1	0	0
Total (best path)	+7		

Figure 4. Best Path Course of Action

Recommendations

The most effective strategy calls for a mix of the three presented options. The Army must leverage existing space-based capabilities and maintain the research and development infrastructure to adapt new technologies. It must utilize a developmental, cradle-to-grave approach where the need is unique or the need to capability gap is too large. Finally, the Army must have the expertise resident in the future force to ensure the engagement of enemy ground segments with lethal and/or non-lethal fires once within the operational reach of the ground force. The following list contains five specific recommendations to achieve Army space control needs:

1) The Army space community should review the Air Force Strategic Master Plan, identify discontinuities between that plan and Army transformational and near-term requirements concerning space operations, and create a roadmap to mitigate these shortfalls. There may be an opportunity for funding assistance in bilateral agreements with, for example, the Marine Corps.

2) The Army should dramatically increase the Army space expertise presence in joint and Service commands responsible for space operations. This facilitates joint coordination and assists in the development of common space capability aims and goals.

3) The Army should ensure documentation of space control requirements in future force development mission needs statements and CONOPs. The documented requirements are then compared to naval and Air Force long range plans to determine if an unacceptable need-to-capability gap exists.

4) The Army should seek to be formally designated the proponent for development of non-lethal, temporary negation from the ground to space across the spectrum of ISR collectors. The Army needs this capability for force protection and information superiority today. The projected 2030 Air Force timeframe for full operational capability is unacceptable.¹⁴³

5) The Army Space and Missile Defense Command (SMDC) should ensure a balance between space and missile defense efforts. National missile defense is a critical issue but so is space control. The DoD's Missile Defense Agency (MDA) has the mission to "develop and field an integrated ballistic missile defense system capable of providing a layered defense for the homeland, deployed forces, friends, and allies against ballistic missiles of all ranges in all phases of flight."¹⁴⁴ While the Army has proponent responsibilities, the MDA receives the funding. The Patriot Advanced Capability-3 program was the only MDA procurement line item in FY 04 and it was Army dollars allocated to that capability.¹⁴⁵ The MDA's budget for FY 05 is projected to

¹⁴³ Department of the Air Force, Air Force Space Command, "Strategic Master Plan: FY 06 and Beyond", Peterson AFB, CO (01 October 2003):24; available from <http://www.peterson.af.mil/hqafspc/Library/AFSPCOffice/Final%2006%20SMP--Signed!v1.pdf>; Internet; accessed 22 February 2004.

¹⁴⁴ Department of Defense, Missile Defense Agency, MDALink, "Mission Statement", available from <http://www.acq.ods.mil/bmdo/bmdolink/html/missionl.html>; Internet; accessed 25 February 2004.

¹⁴⁵ Department of Defense, Missile Defense Agency, MDALink, "FY 04 Authorization Funding Track (TY \$ In Millions)", available from <http://www.acq.osd.mil/bmdo/bmdolink/pdf/fy04auft.pdf>; accessed 25 February 2004.

increase to \$9.1 billion.¹⁴⁶ SMDC must ensure the equitable allocation of limited Major Command (MACOM) and Service dollars between space and missile defense where DoD dollars are scarce or unavailable.

Transition

Transition from the current Army posture regarding space control to the recommended posture in time to meet the needs of an expeditionary, jointly interdependent future Army force requires an immediate refocus of effort. First, disconnects in capability development timelines require engagement with the Air Force at the highest levels. Air Force long-range plans for space require joint discussion and decision due to their role of DoD space proponent. Increased presence of Army space operations officers at joint and component commands facilitates early adjudication of capability development priority disconnects. Therefore, a second interim step is the associated requirement for an increase in Army space functional area accessions. This increased presence also provides a conduit for the transmission of the other Services' need-identification allowing for an early assessment of possible Army funding focus to ensure a particular capability's development. The two intermediate steps of engagement and an increase in the number of Army space operations officers address the external-focus requirements to enact the first three recommendations.

Additional transitory steps are required to enable realization of the final two recommendations and are internally focused. Designation as the proponent for non-lethal, temporary negation or any other capability not met by other Services within the determined timeline requirement is essential to address Army tactical and operational needs. This is enabled through an immediate focus of research and development effort and funding in these areas. Under the new Joint Capabilities Integration and Development System (JCIDS), the first Service

¹⁴⁶ Jeremy Pelotsky, Reuters, "Bush Seeks Big Jump in Missile Defense Spending," available from http://aolsvc.news.aol.com/news/article.adp?id=20040130125209990014&_ccc=1; Internet; accessed 30 January 2004.

to demonstrate a capability is at an advantage for maintaining the developmental lead. The other Services, if they wish to assume the lead, must not only demonstrate a viable capability but also justify why that first Service's capability is inadequate. Concerning ISR negation, the results of this study support increased funding and focus in this area. Finally, the transitory step of deliberate management of General Officer career paths concerning space assignments enables balance between missile and space within the Army. Human nature tends to support the assumption that if presented with two areas of focus, one familiar and one less so, focus of initial effort migrates toward the known. The elimination of any possible unintended bias concerning space and missile balance is achieved through career management which ensures potential future Commanding Generals of SMDC spend a majority of O-7 and O-8 time in joint and Army space assignments.

Conclusion

Space control is an area requiring greater focus by all the Services. Each Service follows its own set of priorities in addressing the four elements of the space control mission area: surveillance, protection, prevention, and negation. Adding to this dilution of effort is the multiple taskings of DoD's space elements. The United States Strategic Command (USSTRATCOM) headquarters consists of five elements; combat support, global operations, policy/resources/requirements, strike warfare, and Joint Force Headquarters- Information Operations.¹⁴⁷ Space capabilities and operational support are part of the USTRATCOM mission statement¹⁴⁸ and space operations are one of the command mission areas.¹⁴⁹ Responsibility for

¹⁴⁷ Public Affairs, U.S. Strategic Command, "Fact File: U.S. Strategic Command Overview;" available from <http://www.stratcom.mil/overview&organization.htm>; Internet; accessed 25 February 2004.

¹⁴⁸ USSTRATCOM, "U.S. Strategic Command SNAP SHOT," January 2004; available from <http://www.stratcom.mil/factsheetshtml/SnapShot.doc>; Internet; accessed 25 February 2004.

¹⁴⁹ USSTRATCOM, "Strategic Command Biography: Admiral James O. Ellis, Jr.," January 2004; available from <http://www.stratcom.mil/BIOS/ellis.htm>; Internet; accessed 25 February 2004.

space within this command appears to be spread over its directorates. The Air Force divides its resources between air and space. The Navy looks at both network and space operations. The Army is concerned with both space and missile defense. This environment of split priorities creates difficulty in obtaining unity of effort concerning space in general, let alone space control. The quote from the 2001 Space Commission that admonished the Air Force for not treating air and space equally is an applicable warning to all the Services.

Space Control is critical to the success of the Army's future force. The information superiority and lethality required by the joint and expeditionary Army are only possible through continued U.S. space dominance. The end state of joint interdependence may remove the need for Army space control involvement. However, the day when all members of the joint team can bring their full capabilities to bear at any point on the globe at the same time is beyond even the 2020 timeframe. In the interim, initial-entry forces need access to space control methods and capabilities until the joint force achieves full spectrum dominance. Given the tempo and requirements of the global war on terrorism, the Army cannot wait until space control migrates to the top of another Service's priority list. The current threat demands some of these capabilities now and, DoD-wide, the armed services may have waited too long already. Army efforts to address the gap between need and capability are feasible, acceptable, and suitable. The critical requirement, however, is joint collaboration and cooperation to ensure common aims and goals agreed to and approved by DoD and the Executive Agent for Space. Army efforts are thus assured to not waste resources and these efforts can compliment the other joint team member's efforts when negation rises to the top of their priority list.

The recent statement by the Honorable Peter B. Teets to the House Armed Services committee is encouraging for proponents of joint effort concerning space control capability development. It mentions the intent to award a contract for the design and development of a

“multi-Service Army/Air Force Counter Surveillance and Reconnaissance System (CSRS).”¹⁵⁰

This system provides the capability of reversible effects to counter surveillance and reconnaissance satellites. However, the given Initial Operational Capability (IOC) date of FY 09 conflicts with the Air Force’s Strategic Master Plan. This discontinuity between the Executive Agent and the Service with proponency for space highlights the need for active Army involvement in capability development and supports the granting of proponency for this capability to the Army. The Service with the greatest need for a type of space control capability must lead the effort to bring that capability to realization. It is the best way to ensure joint team needs are met.

The Army is transforming to a joint, expeditionary force. Joint interdependence will create a more efficient military force through reduction in redundant capabilities. Until joint interdependence realization, however, the Army must pursue those capabilities that ensure its effectiveness as part of an evolving joint team.

¹⁵⁰ Congress, House of Representatives, committee on Armed Services, Subcommittee on Strategic Forces, *Statement by the Under Secretary of the Air Force, the Honorable Peter B. Teets, Regarding the Fiscal Year 2005 National Defense Authorization Budget Request: Status of the Space Programs*, 108th Cong., 25 February 2004, 7; available from <http://armedservices.house.gov/openingstatementsandpressreleases/108thcongress/04-02-25teets.html>; Internet; accessed on 10 March 2004.

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